01-807

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Applicant:	Yamamoto, Seto, Sato, Kuroki
Serial Number:	10/020764
Filed:	2001.12.12
Title:	Substrate Laser Marking
Examiner:	Hoa B. Trinh
Group Art Unit:	2814
Attorney Docket:	01-807

APPLICANTS' REPLY BRIEF ON APPEAL

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O Box 1450
Alexandria VA 22313-1450

Via Fax at 1.571.273.8300

Sir:

Applicants hereby submit this reply brief on appeal from the examiner's rejection of 2003.06.22 of claims 1-4 and 7-19, in compliance with 37 CFR 41.37 and in response to the examiner's answer dated 2005.07.12. The Commissioner is authorized to charge whatever fee may be associated with the filing of this reply brief, and any other fees required such as extensions of time, to the LSI Logic Corporation deposit account number 12-2252.

I hereby certify that this correspondence is being transmitted by facsimile to the Patent and Trademark Office in accordance with § 1.6(d) on the date below.

2005.08.25
Date

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REPLY TO EXAMINER'S ANSWER

The examiner states in section seven of the answer that the rejections of the claims "stand or fall together because appellant's brief does not include a statement that this grouping of claims does not stand or fall together and reasons in support thereof. See 37 CFR 1.192(c)(7)." However, in the notice of non-compliant appeal brief dated 2005.05.31, the examiner required compliance with 37 CFR 41.37. Therefore, the provisions of 37 CFR 1.192(c)(7) are moot. 37 CFR 41.37 does not require a statement that the claims do not stand or fall together, rather it requires that the claims be separately argued in groups that stand or fall together, which the applicants have done. However, it also suggests that those groups should be placed under a subheading identifying the claims by number, which suggested subheadings applicants have added to this document in section VII below, for additional clarity. Although not required, applicants have additionally added a statement at the beginning of section VII that the claims do not all stand or fall together, as desired by the examiner. Reasons why the claims of each group do not all stand or fall together have been retained at the beginning of each subsection.

In section 11 of the answer, the examiner states that "Woolhouse and Patel are analogous art because both references teach a method of making a hole in the substrate," and also "that the use of laser ablation in Patel would not destroy the invention of Woolhouse, because an artisan can make the V-groove of Woolhouse in the substrate first and then the artisan deposits layer 18 and layer 19 of Woolhouse over at least a portion of the V-groove." Applicants assert that these statements are incorrect and not well founded.

In regard to the first statement of the examiner as given above, Woolhouse describes a chemical etch and Patel describes laser ablation. These methods are not analogous art just because they are both used to remove material from a substrate, as suggested by the examiner. Etching is a process that is very precise, slow, and controllable in comparison to laser ablation. Laser ablation is very rough, fast, and uncontrollable in comparison to etching. There is no reason to assume that these two processes are interchangeable, any more than there is to assume that other methods of

removing material from a substrate, such as sawing (used to singulate integrated circuits) could be interchanged with them.

For example, in the specific case – and in regard to the second statement of the examiner as given above – Woolhouse uses an etchant that does not attack the layers 18 and 19, but does attack underlying layers, forming a V groove. This is important because the layer 18 – at least – must be in place prior to the etch of the V groove, because it helps define the desired shape of the V groove. A laser ablation would necessary remove the overlying layers 18 and 19 in the formation of the V groove. The examiner asserts that these layers could then be reformed over the V groove. Applicants assert, however, that such a process does not currently exist in microelectronics fabrication technology. Further, even if such a process did exist, there would be no motivation to form the V groove with a laser, destroying the layers 18 and 19 in the process, and then reform the destroyed layers 18 and 19.

The entirety of applicants' updated brief on appeal is provided below.

I. Real Party In Interest

The real party in interest is LSI Logic Corporation, a corporation of Delaware, and assignee of record of the entire right, title, and interest in and to the invention and application for patent thereon from the inventors Haruhiko Yamamoto, Hideaki Seto, Nobuyoshi Sato, and Kyoko Kuroki.

II. Related Appeals And Interferences

There are no related appeals or interferences.

III. Status Of Claims

Claims 1-4 and 7-19 are in the case and stand rejected under 35 USC § 103(a) over USPN 4,237,601 to Woolhouse et al. in view of USPN 6,642,477 to Patel et al. Claims 5-6 and 20 have been cancelled. The claims on appeal are claims 1-4 and 7-19, as given in the Appendix.

IV. STATUS OF AMENDMENTS

Applicants amended the claims in response to the first office action, which amendments have all been entered in the case. No amendments have been proposed subsequent to final rejection.

V. SUMMARY OF CLAIMED SUBJECT MATTER

A concise summary of the subject matter claimed in the independent claims 1 and 14 is now provided with reference to claim 1. References to the text of the specification are made parenthetically, in the following manner (Spec. Page:Lines). References to the figures are also made parenthetically, in the following manner (Fig. Number:Element).

Claim 1 recites a method for a method for forming a feature (Fig. 2:12) in a substrate (Fig. 2:10), where residue (Fig. 1:16) within the feature (Fig. 2:12) can be easily removed (Spec. 6:5-8). An upper sidewall portion (Fig. 2:24) of the feature (Fig. 2:12) is formed by laser ablation (Spec. 5:12-13), where the upper sidewall portion (Fig. 2:24) forms a void (Fig. 2:12) (Spec. 5:20-23) in the substrate (Fig. 2:10). The upper sidewall portion (Fig. 2:24) has an upper sidewall angle (Fig. 2:β) (Spec. 5:14-19). A lower sidewall portion (Fig. 2:26) of the feature (Fig. 2:12) is formed by laser ablation (Spec. 5:12-13), where the lower sidewall portion (Fig. 2:26) forms a void (Fig. 2:12) (Spec. 5:20-23) in the substrate (Fig. 2:10). The lower sidewall portion (Fig. 2:26) has a lower sidewall angle (Fig. 2:δ) (Spec. 5:14-19). The upper sidewall angle (Fig. 2:β) of the upper sidewall portion (Fig. 2:24) is shallower than the lower sidewall angle (Fig. 2:δ) of the lower sidewall portion (Fig. 2:26) (Spec. 5:14-19).

As described in additional claims, the method is additionally directed toward forming indicia on integrated circuit substrates, which indicia remain clean and therefore highly visible during integrated circuit fabrication processes, and which also do not contaminate such integrated circuit fabrication processes (Spec. 5:29-6:8).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Whether claims 1-4 and 7-19 are patentable under 35 USC § 103(a) over Woolhouse et al. in view of Patel et al.

VII. ARGUMENTS

(i) WHETHER CLAIMS 1-4 AND 7-19 ARE PATENTABLE UNDER 35 USC § 103(A) OVER WOOLHOUSE ET AL. IN VIEW OF PATEL ET AL.

Applicants assert that the claims do not stand or fall together as a single group, but rather in the groups as indicated in the following subheadings, as described in detail below.

CLAIMS 1 AND 11

Claims 1 and 11 are patentably distinct from the other claims because they are the broadest claims directed to forming a feature, and thus include a set of limitations and a scope that is broader than any of the other groups, as described more completely below.

Independent claim 1 claims, *inter alia*, forming a feature ***by laser ablation***, where the feature has an upper sidewall portion with an upper sidewall angle, and a lower sidewall portion with a lower sidewall angle, where the upper sidewall angle is shallower than the lower sidewall angle. Woolhouse et al. do not describe such a process.

Woolhouse et al. describe the formation of V grooves 22, which "grooves are then ***etched*** into the bottoms of the channels ***with an anisotropic etchant*** that forms V-grooves 22" (column 4, lines 39-41, emphasis added). A great deal of detail as to the specifics of the ***chemical etch*** are then provided. Woolhouse et al. do not describe laser ablation of the wafer, while claim 1 clearly restricts the method to using laser ablation.

Further, the V groove as described by Woolhouse et al. could not possibly be formed by a laser ablation process, because layers 18 and 19 remain intact over at least portions of the V groove 22. Thus, it would be impossible for a laser to ablate those portions of the V groove 22 that are outside of an attainable angle from the laser. Therefore, while Woolhouse et al. describe a feature 22, ***a portion of which*** has a cross-section that is similar in some respects to the feature described in claim 1 (it is noted that the shape of the entire feature in Woolhouse et al. is different from the presently claimed feature), the method by which that feature is formed is completely different from ***the method that is claimed*** in claim 1.

Patel et al. do not remedy the deficiencies of Woolhouse et al. Patel et al. describe laser drilling a counter tapered through hole in a material, by rotating a laser beam relative to the cut material to form a through hole having a larger exit than entrance. Thus, Patel et al. describe cutting a hole with a laser, where the laser is angled relative to the surface of the work piece, and one or the other of either the work piece or the laser is rotated around an axis that is common to both the laser and the work piece. This necessarily forms a hole that is counter tapered – or in other words, a hole that has a taper that is the opposite of the taper of the groove described by Woolhouse et al. Thus, there is no combination of Patel et al. with Woolhouse et al. that produces the present method as claimed.

For example, it is a fundamental aspect of the method of Patel et al. that the laser cuts completely through the work piece. Cutting completely through the work piece of Woolhouse et al. is not desirable. Further, it is another fundamental aspect of the method of Patel et al. that the laser forms a larger diameter exit hole, and a smaller diameter entrance hole – or in other words, forms a counter tapered hole. Woolhouse et al. describe a V groove that is oppositely tapered – with a large diameter entrance and a smaller diameter bottom. Further yet, as introduced above, Woolhouse et al. describe retaining two layers 18 and 19 that are retained above the chemically etched V groove. There is no laser technique that could produce such a feature, because it would be unable to clear away material underneath the overhang of the layers 18 and 19.

Thus, as described above, the combination of Woolhouse et al. and Patel et al. – assuming for the moment that any logical combination of the two references can be made – fails in at least three ways to make obvious the present invention as recited in claim 1. Neither the method as presently claimed nor the feature as presently claimed is described or suggested by Woolhouse et al., Patel et al., or their combination.

Therefore, claim 1 patentably defines over Woolhouse et al. in view of Patel et al., and the rejection of claim 1 is in error. Dependent claim 11 depends from independent claim 1, and is likewise a Group I claim. Thus, claim 11 patentably defines over Woolhouse et al. in view of Patel et al. Therefore, the rejection of claim 11 is in error.

CLAIMS 2-3 AND 8-10

Claims 2-3 and 8-10 are patentably distinct from the other claims because they describe a method for forming a feature in a substrate, where the feature has specific additional characteristics, and thus includes a set of limitations with a breadth that is different from any of the other claims, as described more completely below.

Dependent claims 2-3 and 8-10 depend from independent claim 1 and claim, *inter alia*, forming a feature by laser ablation, where the feature has an upper sidewall portion with an upper sidewall angle, and a lower sidewall portion with a lower sidewall angle, where the upper sidewall angle is shallower than the lower sidewall angle, and where (a) the upper sidewall angle is from about thirty degrees to about sixty degrees, (b) the lower sidewall angle is from about sixty degrees to about ninety degree, (c) the upper sidewall portion has a depth of between about four microns and about eight microns, (d) the lower sidewall portion has a depth of between about four microns and about eight microns, or (e) the feature has a depth of no more than about twelve microns. As described above, Woolhouse et al. in view of Patel et al. do not describe such a process. Specifically, Woolhouse et al. in view of Patel et al. do not describe laser ablating a feature having an upper sidewall angle of from about thirty degrees to about sixty degrees. Therefore, claim 2 patentably defines over Woolhouse et al. in view of Patel et al., and the rejection of claim 2 is in error.

CLAIM 4

Claim 4 is patentably distinct from the other claims because it describes a method for forming a feature in a substrate, where a specific order to the method is provided, and thus includes a set of limitations with a breadth that is different from any of the other groups, as described more completely below.

Dependent claim 4 depends from independent claim 1 and claims, *inter alia*, forming a feature by laser ablation, where the feature has an upper sidewall portion with an upper sidewall angle, and a lower sidewall portion with a lower sidewall angle, where the upper sidewall angle is shallower than the lower sidewall angle, and the lower sidewall portion is formed before the upper sidewall portion. Woolhouse et al. in view of

Patel et al. do not describe such a process. Specifically, Woolhouse et al. in view of Patel et al. do not describe laser ablating a feature where the lower sidewall portion is formed before the upper sidewall portion. Therefore, claim 4 patentably defines over Woolhouse et al. in view of Patel et al., and the rejection of claim 4 is in error.

CLAIM 7

Claim 7 is patentably distinct from the other claims because it describes a method for forming a feature in a substrate, where an additional limitation is placed on the method, and thus includes a set of limitations with a breadth that is different from any of the other groups, as described more completely below.

Dependent claim 7 depends from independent claim 1 and claims, *inter alia*, forming a feature by laser ablation, where the feature has an upper sidewall portion with an upper sidewall angle, and a lower sidewall portion with a lower sidewall angle, where the upper sidewall angle is shallower than the lower sidewall angle, and the feature is a blind bore. Woolhouse et al. in view of Patel et al. do not describe such a process. Specifically, Woolhouse et al. in view of Patel et al. do not describe laser ablating a blind bore. Therefore, claim 7 patentably defines over Woolhouse et al. in view of Patel et al., and the rejection of claim 7 is in error.

CLAIMS 12-13

Claims 12-13 are patentably distinct from the other claims because they describe a feature and a substrate including the feature formed by the method, and thus include a set of limitations with a breadth that is different from any of the other groups, as described more completely below.

Dependent claims 12-13 depend from independent claim 1 and claim, *inter alia*, a feature formed by laser ablation, where the feature has an upper sidewall portion with an upper sidewall angle, and a lower sidewall portion with a lower sidewall angle, where the upper sidewall angle is shallower than the lower sidewall angle, and a substrate having such features. Woolhouse et al. in view of Patel et al. do not describe such features or substrates. Specifically, Woolhouse et al. in view of Patel et al. do not describe features that are formed by laser ablation, which features have a far different physical appearance

from features that are formed by the methods described by Woolhouse et al. in view of Patel et al., as enumerated above. Therefore, claims 12-13 patentably define over Woolhouse et al. in view of Patel et al., and the rejection of claims 12-13 are in error.

CLAIM 14

Claim 14 is patentably distinct from the other claims because it is the broadest claim that describes a method for forming indicia elements on a substrate, and thus includes a set of limitations with a breadth that is different from any of the other groups, as described more completely below.

Independent claim 14 claims, *inter alia*, forming indicia elements by laser ablation, where the indicia elements have an upper sidewall portion with an upper sidewall angle, and a lower sidewall portion with a lower sidewall angle, where the upper sidewall angle is shallower than the lower sidewall angle. Woolhouse et al. in view of Patel et al. do not describe such a process. Specifically, Woolhouse et al. in view of Patel et al. do not describe laser ablating indicia elements. Therefore, claim 14 patentably defines over Woolhouse et al. in view of Patel et al., and the rejection of claim 14 is in error.

CLAIMS 15-17

Claims 15-17 are patentably distinct from the other claims because they describe indicia elements that are formed according to a certain order of the method, and thus include a set of limitations with a breadth that is different from any of the other groups, as described more completely below.

Dependent claims 15-17 depend from independent claim 14 and claim, *inter alia*, forming indicia elements by laser ablation, where the indicia elements have an upper sidewall portion with an upper sidewall angle, and a lower sidewall portion with a lower sidewall angle, where the upper sidewall angle is shallower than the lower sidewall angle, and where (a) all upper sidewalls are formed before any of the lower sidewalls, (b) all lower sidewalls are formed before any of the upper sidewalls, or (c) one indicia element is completely formed before moving on to the next indicia element. Woolhouse et al. in view of Patel et al. do not describe such a method. Specifically, Woolhouse et al. in view

of Patel et al. do not describe forming indicia elements by laser ablation in the different orders of formation as describe in claims 15-17. Therefore, claims 15-17 patentably define over Woolhouse et al. in view of Patel et al., and the rejections of claims 15-17 are in error.

CLAIM 18

Claim 18 is patentably distinct from the other claims because it is the only claim directed to forming indicia elements, where the indicia elements have specific additional characteristics, and thus includes limitations with a breadth that are not described in any of the other groups, as described more completely below.

Dependent claim 18 depends from independent claim 14, and therefore claims *inter alia*, forming indicia elements by laser ablation, where the indicia elements have an upper sidewall portion with an upper sidewall angle, and a lower sidewall portion with a lower sidewall angle, where the upper sidewall angle is shallower than the lower sidewall angle, and where the upper sidewall angle is from about sixty degrees to about ninety degrees, the lower sidewall angle is from about sixty degrees to about ninety degrees, the upper sidewall portion has a depth of between about four microns and about eight microns, the lower sidewall portion has a depth of between about four microns and about eight microns, and the indicia element is a blind bore with a depth of no more than about twelve microns. Woolhouse et al. in view of Patel et al. do not describe such a method. Specifically, Woolhouse et al. in view of Patel et al. do not describe forming indicia elements by laser ablation with the specific physical characteristics as describe in claim 18. Therefore, claim 18 patentably defines over Woolhouse et al. in view of Patel et al., and the rejection of claim 18 is in error.

CLAIM 19

Claim 19 is patentably distinct from the other claims because it describes a substrate including the indicia elements formed by the method, and thus includes a set of limitations with a breadth that is different from any of the other groups, as described more completely below.

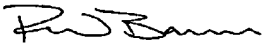
Dependent claim 19 depends from independent claim 14 and claim, *inter alia*, an integrated circuit substrate having indicia elements formed by laser ablation, where the indicia elements have an upper sidewall portion with an upper sidewall angle, and a lower sidewall portion with a lower sidewall angle, where the upper sidewall angle is shallower than the lower sidewall angle. Woolhouse et al. in view of Patel et al. do not describe such indicia elements. Specifically, Woolhouse et al. in view of Patel et al. do not describe indicia elements that are formed by laser ablation, which indicia elements have a far different physical appearance from the cuts that are formed by the methods described by Woolhouse et al. in view of Patel et al., as enumerated above. Therefore, claim 19 patentably defines over Woolhouse et al. in view of Patel et al., and the rejection of claim 19 is in error.

CONCLUSION

In light of the deficiencies of the rejections described at length above, claims 1-4 and 7-19 should be allowed and the rejections to these claims reversed.

Sincerely,

LUEDEKA, NEELY & GRAHAM, P.C.

By: 

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VIII. CLAIMS APPENDIX

1. (previously amended) A method for forming a feature in a substrate, where residue within the feature can be easily removed, the method comprising the steps of:

forming an upper sidewall portion of the feature by laser ablation, the upper sidewall portion forming a void in the substrate, where the upper sidewall portion has an upper sidewall angle, and

forming a lower sidewall portion of the feature by laser ablation, the lower sidewall portion forming a void in the substrate, where the lower sidewall portion has a lower sidewall angle,

where the upper sidewall angle of the upper sidewall portion is shallower than the lower sidewall angle of the lower sidewall portion.

2. (original) The method of claim 1, wherein the upper sidewall angle of the upper sidewall portion is from about thirty degrees to about sixty degrees.

3. (original) The method of claim 1, wherein the lower sidewall angle of the lower sidewall portion is from about sixty degrees to about ninety degrees.

4. (original) The method of claim 1, wherein the lower sidewall portion is formed before the upper sidewall portion is formed.

5. (cancelled)

6. (cancelled)

7. (original) The method of claim 1, wherein the feature comprises a blind bore formed in the substrate.

8. (original) The method of claim 1, wherein the upper sidewall portion has a depth of between about four microns and about eight microns.

9. (original) The method of claim 1, wherein the lower sidewall portion has a depth of between about four microns and about eight microns.

10. (original) The method of claim 1, wherein the feature has a depth of no more than about twelve microns.

11. (original) The method of claim 1, wherein the substrate comprises silicon.

12. (original) A feature formed according to the method of claim 1.

13. (original) An integrated circuit substrate having features formed according to the method of claim 1.

14. (previously amended) A method for forming indicia elements on a substrate, where the indicia elements have a shape that aids in removal of foreign material from the indicia elements on the substrate, the method comprising the steps of:

forming an upper sidewall portion of the indicia elements by laser ablation, the upper sidewall portion forming a void in the substrate, where the upper sidewall portion has an upper sidewall angle,

forming a lower sidewall portion of the indicia elements by laser ablation, the lower sidewall portion forming a void in the substrate, where the lower sidewall portion has a lower sidewall angle,

where the upper sidewall angle of the upper sidewall portion is shallower than the lower sidewall angle of the lower sidewall portion, and

forming the indicia elements in a pattern to form identifying indicia on the substrate.

15. (original) The method of claim 14, wherein all of the upper sidewall portions of all of the indicia elements are formed prior to forming any of the lower sidewall portions of any of the indicia elements.

16. (original) The method of claim 14, wherein all of the lower sidewall portions of all of the indicia elements are formed prior to forming any of the upper sidewall portions of any of the indicia elements.

17. (original) The method of claim 14, wherein a preceding one of the indicia elements is completely formed prior to forming a seceding one of the indicia elements.

18. (previously amended) The method of claim 14, wherein:

the upper sidewall angle of the upper sidewall portion is from about thirty degrees to about sixty degrees,

the lower sidewall angle of the lower sidewall portion is from about sixty degrees to about ninety degrees,

the upper sidewall portion has a depth of between about four microns and about eight microns,

the lower sidewall portion has a depth of between about four microns and about eight microns, and

the indicia element is a blind bore formed in the substrate and has a depth of no more than about twelve microns.

19. (original) An integrated circuit substrate having identifying indicia formed according to the method of claim 14.

20. (cancelled)

IX. EVIDENCE APPENDIX

There is no evidence presented.

X. RELATED PROCEEDINGS APPENDIX

There are no related proceedings.